AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1-7. (Canceled).

8. (Original) A method of manufacturing an ink-jet printing head, comprising the steps of:

forming a plurality of channels in one side of a silicon monocrystalline substrate;

forming an oscillating plate film on the bottom each channel;

C1 forming a piezoelectric thin-film element which comprises a piezoelectric film sandwiched between upper and lower electrodes, on the oscillating plate film; and

forming pressuring chambers in the opposite side of the silicon monocrystalline substrate so as to be opposite to the channels, respectively.

9. (Original) The manufacturing method for the ink-jet printing head according to claim 8, wherein the forming step of the piezoelectric thin-film element comprises the steps of:

forming the lower electrode;

forming the piezoelectric film on the lower electrode;

forming the upper electrode on the piezoelectric film; and

removing a portion of the upper electrode to make an effective width of the upper electrode narrower than an width of the pressurizing chamber.

10. (Original) The manufacturing method for the ink-jet printing head according to claim 9, wherein the forming step of the piezoelectric thin-film element comprises the steps of:

forming a piezoelectric film precursor; and

subjecting the piezoelectric film precursor to a heat treatment in an atmosphere including oxygen so as to change the piezoelectric film precursor to the piezoelectric film.

11. (Original) The manufacturing method for the ink-jet printing head according to claim 9, wherein the removing step comprises the steps of:

forming a pattern of etching mask material which acts as a mask to an etching substance, in the areas of the upper electrode which are desired to leave; and

etching away the areas of the upper electrode that are not covered with the etching mask material.

12. (Original) The manufacturing method for the ink-jet printing head according to claim 9, wherein, wherein removing step of:

removing a portion of the upper electrode by irradiating the areas of the upper electrode desired to remove with using a laser beam.

13-16. (Canceled).

17. (Original) A method of manufacturing an ink-jet printing head having a plurality of pressurizing chamber substrates formed on a silicon monocrystalline substrate, each pressurizing chamber substrate having a plurality of pressurizing chambers formed on one side thereof, comprising the steps of:

making a recess formation including the steps of,

partitioning the silicon monocrystalline substrate into unit areas to be used in forming the pressurizing chamber substrate, and

forming a recess in the side of the pressurizing chamber substrate in which the pressuring chambers are to be formed, for each unit area so as to leave a peripheral area along the circumference of the recess; and

making a pressurizing chamber formation including the steps of,

further forming the pressurizing chambers in the recess formed in the recess making step, and

making the thickness of the peripheral area of the pressuring chamber substrate greater than the height of a side wall for separating the pressurizing chambers from each other.

18. (Original) A method of manufacturing an ink-jet printing head having a plurality of pressurizing chamber substrates formed on a silicon monocrystalline substrate, each

pressurizing chamber substrate having a plurality of pressurizing chambers formed on one side thereof, comprising the steps of:

making a pressurizing chamber including the steps of,

partitioning the silicon monocrystalline substrate into unit areas to be used in forming the pressurizing chamber substrate, and forming pressurizing chambers in the side of the pressurizing chamber substrate in which the pressuring chambers are to be formed, while leaving a peripheral area along the circumference of the unit area; and

making a recess including the steps of,

further forming a recess in the area where the pressurizing chambers are formed in the pressurizing chamber formation step, and

making the thickness of the peripheral area of the pressuring chamber substrate greater than the height of a side wall for separating the pressurizing chambers from each other.

19. (Original) A method of manufacturing an ink-jet printing head having a plurality of pressurizing chamber substrates formed on a silicon monocrystalline substrate, each pressurizing chamber substrate having a plurality of pressurizing chambers formed on one side thereof, comprising the steps of:

making a recess including the steps of,

partitioning the silicon monocrystalline substrate into unit areas to be used in forming the pressurizing chamber substrate, and

forming a recess in the side of the pressurizing chamber substrate opposite to the side on which the pressurizing chambers are formed in each unit area, while leaving a peripheral area along the circumference of the unit area, wherein the mechanical strength of the silicon monocrystalline substrate is maintained by increasing the thickness of the pressurizing chamber substrate in the peripheral area than the thickness of the pressurizing chamber substrate in the recess.

20. (Original) The manufacturing method for the ink-jet printing head according to claim 19, wherein the making a recess further comprises the steps of:

forming a layer to be processed;

providing the layer to be processed with a resist and patterning the resist;

etching the layer to be processed corresponding to the recess masked in the resist mask formation step;

further etching the area of the silicon monocrystalline substrate from which the layer to be processed has been removed as a result of the etching step; and

forming a layer to be processed in the recess etched in the recess etching step.

21. (Original) The manufacturing method for the ink-jet printing head according to claim 19, further comprising the steps of:

forming a piezoelectric thin film sandwiched between electrode layers, in the recess formed in the recess forming step;

forming a resist on the piezoelectric thin-film formed in the piezoelectric thin-film forming step, by a resilient roller;

exposing the silicon monocrystalline substrate having the resist formed thereon in the resist forming step;

developing the silicon monocrystalline substrate exposed in the exposing step;

etching the piezoelectric thin film having the resist formed thereon in the developing step, so as to form a piezoelectric thin-film element; and

forming the pressurizing chambers on the other side of the silicon monocrystalline substrate so as to correspond to the piezoelectric thin-film elements formed in the etching step.

22. (Original) The manufacturing method for the ink-jet printing head according to any one of claims 17 through 21, further comprising the step of:

separating the recess that does not include the peripheral area from the silicon monocrystalline substrate so as to individually separate the pressurizing chamber substrates, when the pressurizing chamber substrate is separated from each unit area after the pressurizing chamber substrates have been formed.

23. (Original) The manufacturing method for the ink-jet printing head according to any one of claims 17 through 21, further comprising the step of:

separating the pressurizing chamber substrates from the silicon monncrystalline substrate so as to include the peripheral area, so that the pressurizing chamber substrates are individually

separated from each other, when the pressurizing chamber substrate is separated from each unit area after the pressurizing chamber substrates have been formed.

24. (New) A method of manufacturing an ink-jet printing head, comprising the steps of:

forming a recess in a first side of a pressurizing chamber substrate so as to leave a peripheral area along the circumference of the recess;

forming a plurality of pressurizing chambers in the recess; and

forming an oscillating plate film on a second side of the pressurizing chamber substrate opposite the first side,

wherein a side wall separates a first pressurizing chamber from a second pressurizing chamber, and

wherein a thickness of the peripheral area is greater than a height of the side wall.

25. (New) The manufacturing method for the ink-jet printing head according to claim 24, further comprising the step of forming a plurality of piezoelectric elements corresponding to the pressurizing chambers,

wherein each piezoelectric element is sandwiched between an upper electrode and a lower electrode and is disposed on the oscillating plate film.

26. (New) The manufacturing method for the ink-jet printing head according to claim 25, wherein a width of each piezoelectric element substantially conforms to a width of its corresponding pressurizing chamber.

27. (New) The manufacturing method for the ink-jet printing head according to claim 24, wherein the pressurizing chamber substrate is a silicon monocrystalline substrate.

28. (New) The manufacturing method for the ink-jet printing head according to claim 24, further comprising:

partitioning a wafer to form the pressurizing chamber substrate along with a plurality of other pressurizing chamber substrates;

forming a recess in a side of each pressurizing chamber substrate; and

forming a plurality of pressurizing chambers in each recess.

29. (New) The manufacturing method for the ink-jet printing head according to claim 28, wherein the wafer is a silicon monocrystalline substrate.

30. (New) The manufacturing method for the ink-jet printing head according to claim 28, wherein the wafer has a thickness of approximately 300 μm.

31. (New) The manufacturing method for the ink-jet printing head according to claim 28, wherein the wafer has a diameter d, such that 4 inches $\leq$ d $\leq$ 8 inches.

32. (New) A method of manufacturing an ink-jet printing head, comprising the steps of:

forming a plurality of pressurizing chambers in a first side of a pressurizing chamber substrate, while leaving a peripheral area along the circumference of the pressurizing chamber substrate;

forming a recess in an area where the pressurizing chambers have been formed; and

forming an oscillating plate film on a second side of the pressurizing chamber substrate opposite the first side,

wherein a side wall separates a first pressurizing chamber from a second pressurizing chamber, and

wherein a thickness of the peripheral area is greater than a height of the side wall.

33. (New) The manufacturing method for the ink-jet printing head according to claim 32, further comprising the step of forming a plurality of piezoelectric elements corresponding to the pressurizing chambers,

wherein each piezoelectric element is sandwiched between an upper electrode and a lower electrode and is disposed on the oscillating plate film.

34. (New) The manufacturing method for the ink-jet printing head according to claim 33, wherein a width of each piezoelectric element substantially conforms to a width of its corresponding pressurizing chamber.

35. (New) The manufacturing method for the ink-jet printing head according to claim 32, wherein the pressurizing chamber substrate is a silicon monocrystalline substrate.

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36. (New) The manufacturing method for the ink-jet printing head according to claim 32, further comprising:

partitioning a wafer to form the pressurizing chamber substrate along with a plurality of other pressurizing chamber substrates;

forming a plurality of pressurizing chambers in each pressurizing chamber substrate; and

forming a recess in an area of each pressurizing chamber substrate where the pressurizing chambers have been formed.

37. (New) The manufacturing method for the ink-jet printing head according to claim 36, wherein the wafer is a silicon monocrystalline substrate.

38. (New) The manufacturing method for the ink-jet printing head according to claim 36, wherein the wafer has a thickness of approximately 300 μm.

39. (New) The manufacturing method for the ink-jet printing head according to claim 36, wherein the wafer has a diameter d, such that 4 inches $\leq$ d $\leq$ 8 inches.

40. (New) A method of manufacturing an ink-jet printing head, comprising the steps of:

forming at a recess in a first side of a pressurizing chamber substrate;

forming an oscillating plate film within the recess;

forming a plurality of piezoelectric elements within the recess, each piezoelectric element being sandwiched between an upper electrode and a lower electrode and being disposed on the oscillating plate film; and

forming a plurality of pressurizing chambers in a second side of the pressurizing chamber substrate.

41. (New) The manufacturing method for the ink-jet printing head according to claim 40, wherein a width of each piezoelectric element substantially conforms to a width of its corresponding pressurizing chamber.

42. (New) The manufacturing method for the ink-jet printing head according to claim 40, wherein the pressurizing chambers are formed at positions in the second side of the pressure generating substrate that correspond to the positions of the piezoelectric elements formed within the recess in the first side of the pressurizing chamber substrate.

43. (New) The manufacturing method for the ink-jet printing head according to claim 40, wherein the pressurizing chamber substrate is a silicon monocrystalline substrate.

44. (New) The manufacturing method for the ink-jet printing head according to claim 40, further comprising:

partitioning a wafer to form the pressurizing chamber substrate along with a plurality of other pressurizing chamber substrates;

forming a recess in a first side of each pressurizing chamber substrate;

forming an oscillating plate film within each recess;

forming a plurality of piezoelectric elements within each recess, each piezoelectric element being sandwiched between an upper electrode and a lower electrode and being disposed on the oscillating plate film formed within the recess; and

forming a plurality of pressurizing chambers in a second side of each pressurizing chamber substrate.

45. (New) The manufacturing method for the ink-jet printing head according to claim 44, wherein the wafer is a silicon monocrystalline substrate.

46. (New) The manufacturing method for the ink-jet printing head according to claim 44, wherein the wafer has a thickness of approximately 300 μm.

47. (New) The manufacturing method for the ink-jet printing head according to claim 44, wherein the wafer has a diameter d, such that 4 inches $\leq$ d $\leq$ 8 inches.

48. (New) A method of manufacturing an ink-jet printing head having a pressurizing chamber substrate formed with a plurality of other pressurizing chamber substrates on a wafer, each pressurizing chamber substrate having a plurality of pressurizing chambers formed on one side thereof, comprising the steps of:

forming a recess in a first side of the wafer in which the pressuring chambers are to be formed, so as to leave a peripheral area along the circumference of the recess;

partitioning the wafer into unit areas to be used in forming each pressurizing chamber substrate, and

for each partitioned unit area, forming the pressurizing chambers in that part of the recess corresponding to the partitioned unit area.

49. (New) The manufacturing method for the ink-jet printing head according to claim 48, wherein the wafer is a silicon monocrystalline substrate.

50. (New) The manufacturing method for the ink-jet printing head according to claim 48, wherein the wafer has a thickness of approximately 300 μm.

51. (New) The manufacturing method for the ink-jet printing head according to claim 48, wherein the wafer has a diameter d, such that 4 inches $\leq$ d $\leq$ 8 inches.